Impact of the SARS-CoV-2 Pandemic and First Lockdown on Pregnancy Monitoring in France: the COVIMATER Cross-sectional Study

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Abstract

Background

In the context of the SARS-CoV-2 pandemic, consultations and pregnancy monitoring examinations had to be reorganised urgently. In addition, women themselves may have postponed or cancelled their medical monitoring for organisational reasons, for fear of contracting the disease caused by SARS-CoV-2 (Covid-19) or for other reasons of their own. Delayed care can have deleterious consequences for both the mother and the child. Our objective was therefore to study the impact of the SARS-CoV-2 pandemic and the first lockdown in France on voluntary changes by pregnant women in the medical monitoring of their pregnancy and the associated factors.

Methods

A cross-sectional study was conducted in July 2020 using a web-questionnaire completed by 500 adult (>18 years old) pregnant women during the first French lockdown (March-May 2020). A robust variance Poisson regression model was used to estimate adjusted prevalence ratios (aPRs).

Results

Almost one women of five (23.4%) reported having voluntarily postponed or foregone at least one consultation or pregnancy check-up during the lockdown. Women who were professionally inactive (aPR=1.98, CI95%[1.24-3.16]), who had experienced serious disputes or violence during the lockdown (1.47, [1.00-2.16]), who felt they received little or no support (1.71, [1.07-2.71]), and those who changed health professionals during the lockdown (1.57, [1.04-2.36]) were all more likely to have voluntarily changed their pregnancy monitoring. Higher level of worry about the pandemic was associated with a lower probability of voluntarily changing pregnancy monitoring (0.66, [0.46 -0.96]).

Conclusions

Our results can guide prevention and support policies for pregnant women in the current and future pandemics.

Introduction

Data from previous coronavirus outbreaks in 2002 and 2013 showed that pregnancy was a risk factor for severe forms of associated respiratory diseases. More specifically, SARS-CoV-1 and MERS-CoV were associated with significant acute respiratory distress syndrome (1,2). This fact, together with recommendations of learned societies (3,4), prompted several countries, including France, to declare in March/April 2020 that pregnant women should be considered a population at greater risk of severe forms of COVID-19, the disease caused by SARS-CoV-2 (5–9). In the absence of vaccines and effective pharmaceutical treatments at that time, most governments decided to reduce the spread of the virus by implementing strict lockdowns of their entire population for several months. These actions together with

to the increased influx of patients suffering from COVID-19 brought about major changes in the organisation of health systems (10,11), including the organisation of hospital gynaecological departments (10–12). In the United States (U.S.) a longitudinal study reported a decrease of 20% in on-site abortion during the first trimester of pregnancy between February and June 2020. In addition, a decrease in on-site consultations for abortion follow-up was observed, prompting an increase in teleconsultations and medical abortion at home (12). Another U.S. study, conducted between mid-March and mid-May 2020 showed that nearly one-third of pregnancy monitoring visits were modified, cancelled or rescheduled (13). In France, a longitudinal study on the surgical management of gynaecological cancers reported a change in medical management for 27% of its participants, including 23.2% for whom surgery was either postponed or cancelled due to the influx of patients infected with SARS-CoV-2 during the first lockdown (14), which took place between 17 March and 11 May 2020.

With regard to pregnancy, monitoring consultations were initially deprogrammed by French health professionals before official guidelines recommended that follow-up be maintained and reorganised (15,16). The French healthcare system adapted very quickly to the crisis, offering 100% reimbursed tailored teleconsultation (video and telephone-based consultations) to pregnant women (21). Maternity wards and private offices also changed pregnancy monitoring practices. More specifically, partners were not allowed to be present during consultations, obstetric examinations or during hospitalization for childbirth, except under certain conditions (18). Only partners were allowed to visit after childbirth (15,18).

In addition to the reorganisation of the health sector, some women voluntarily (*i.e.*, spontaneously) modified their medical monitoring for different reasons, for example organisational scheduling (16,19).

Any postponement or foregoing of consultations or examinations in the context of pregnancy is of particular concern for the health of both the mother and child, as screening must be performed within specific time windows (24). More specifically, failure to monitor foetal weight gain, screen for gestational diabetes and hypertension, has deleterious consequences for the newborn (25–28).

In the context of the SARS-CoV-2 pandemic, it is essential that the health management of pregnant women be continually adapted to best meet the changing needs in this dynamic context. To do this, it is necessary to understand the reasons why pregnant women voluntarily change their pregnancy monitoring.

Our objective was to study i) the effects of the SARS-CoV-2 pandemic and France's first associated lockdown on the frequency of voluntary changes in pregnancy monitoring by women during the country's first lockdown, and ii) associated factors.

Methods

Population and data source (Covimater)

From an internet access panel of volunteer internet users (BVA group), we created a non-probability study (Covimater) sample of 500 adult women who were pregnant during the first lockdown in France (17 March – 11 May 2020). Participants were 18 years old and over and residents in metropolitan France. Women who gave birth in the two first weeks of the lockdown and those whose pregnancy began during the last two weeks were not included due to their limited exposure to it. Eligible women were invited to answer a web-based questionnaire between 6 and 20 July 2020.

Survey methodology

Covimater used quotas sampling, whereby the study sample is assigned a structure similar to that of the target population (i.e., all pregnant women) in order to tend towards representativeness. The population of parents of children under one year old - as per the National Institute of Statistics and Economic Studies 2016 census - was used to obtain the quotas (25). Only mothers' quotas were used to calculate weightings using Newton's algorithm (26). Specifically, these data comprised age group, socio-professional category (SPC), region of residence, size of urban area, and parity. No significant difference in age group, region of residence or parity was observed between women participating in Covimater and the whole population of women in France who gave birth in a hospital maternity ward (i.e., 99% of French pregnant women population (27)).

Changes in pregnancy monitoring at the initiative of pregnant women

For the present study, women who voluntarily changed their pregnancy monitoring during the lockdown were defined as those who reported at least one of the following in the questionnaire: (i) foregoing pregnancy examinations, (ii) voluntarily postponing or cancelling pregnancy consultations, (iii) delaying the start of monitoring (i.e., not starting monitoring despite a gestational age of over 15 weeks) (27).

The reasons for changes in pregnancy monitoring were explored through 13 binary questionnaire items covering different themes (lockdown, SARS-CoV-2 infection, and organisational problems, specifically personal and healthcare-based).

Covariates

Explanatory variables were divided into five main themes:

Socio-demographic: age, country of birth, socio-professional category (SPC) reduced into SPC+ (self-employed women, managers, intermediate professions), SPC- (employees, blue-collar workers) and Inactive (students and other professionally inactive), education level, the perception of their financial situation, having in the household during the lockdown, a partner and/or one or more children under the age of six, size of urban area and geographical area of residence according to the level of active circulation of the virus and strain on hospital intensive care unit capacity in May 2020 (four colours-according to increasing epidemic pressure on the healthcare system) (28).

Lockdown-related: workload, access to a private or common outdoor space, level of knowledge about the virus' modes of transmission, self-perceived social support (*i.e.*, from family, friends, etc.), having experienced serious arguments and/or a climate of violence, having symptoms which led the participant to think they had COVID-19, having loved ones who had either been diagnosed with COVID-19 or had symptoms suggestive of the disease.

Perception of the epidemic: participants' perceived general worry about the pandemic situation in France (scale from 0, not at all worried to 10, very worried).

Pregnancy and health: parity, gestational age at the end of lockdown or at the time of the questionnaire, at least one pre-existing chronic pathology or pregnancy-related pathology, overweightness/obesity (Body Mass Index = $> 25\text{kg/m}^2$).

Healthcare during lockdown: unsuccessful attempts to have an exchange with healthcare professionals about the pregnancy and the pandemic, having been followed by a professional other than the usual one, having teleconsultations (video or telephone), having childbirth preparation sessions, having at least one pregnancy check-up or consultation due to pandemic-related restrictions the participant's partner or person providing support during pregnancy was not allowed to attend.

Statistical analysis

A robust variance Poisson regression model was used to estimate unadjusted and adjusted prevalence ratios (aPR) (29) for voluntary changes in pregnancy monitoring. Factors associated with this outcome which had a p-value < 0.20 in bivariate analysis or which were judged to be clinically relevant based on the literature (gestational age at the time the study questionnaire was completed, gestational age at the end of the lockdown period, parity) were introduced into the multivariate model. When several variables were possibly collinear, the model with the best likelihood score (lowest Bayesian Information Criterion) was selected. Fractional polynomials showed a linear relationship between continuous variables included in the models and the studied prevalence of the outcome. The final model included the variables independently associated with the variable of interest (p-value < 0.05) after epidemiological reflection and according to the clinical relevance of each variable at each step of the procedure. A manual stepwise descending approach was applied.

Estimates of aPR, their 95% confidence intervals (95% CI) and associated p-values were presented. As indicated by Zou, PRs are interpreted in the same way as relative risks (30).

All statistical analyses were performed using Stata software ®version 14.2 (Stata Corp., College Station, TX, USA).

Results

Characteristics of women included in Covimater (Table 1)

The mean age was of the Covimater study sample ($n = 500$) was 31.4 years ($sd = 5.1$). Four-fifths (78.1%) had a secondary school diploma or higher level of education, 36.1% were classified SPC-, 25.5% were Inactive, 31.7% declared they just got by financially, while 19.1% reported that they could not make ends meet.

Table 1

Description of pregnant women during the first COVID-19-related lockdown (March to May 2020) who participated in the Covimater survey (n = 500), France, (July 2020)

	N (%)*		95%CI*
Socio-demographic characteristics and variables related to the first lockdown			
Age (in years)			
18–24	53	(10.7)	7.4–15.2
25–34	323	(64.6)	59.7–69.2
35–49	124	(24.7)	21.1–28.8
Socio-professional category (SPC)**			
SPC +	192	(38.4)	33.9–43.2
SPC -	180	(36.1)	31.8–40.6
Inactive	128	(25.5)	20.5–31.2
Educational level			
Equal to or higher than secondary school diploma	391	(78.1)	73.6–82.1
Lower than secondary school diploma	109	(21.9)	17.9–26.4
Perceived financial situation			
Comfortable	246	(49.2)	44.2–54.2
Just getting by	159	(31.7)	27.2–36.6
Difficult to make ends meet	95	(19.1)	15.2–23.7
Social Security Healthcare Insurance	494	(98.7)	96.9–99.5
Region of residence according to SARS-CoV-2 healthcare system severity (colour-coded)***			
Green zone	127	(25.4)	21.1–30.2

	N (%)*		95%CI*
Orange zone	150	(30.0)	25.7–34.7
Red zone	223	(44.6)	39.7–49.6
Child(ren) under 6 years of age in the household during the lockdown	234	(46.8)	41.8–51.8
Working conditions during the lockdown (n = 386)****			
Working from home	96	(24.8)	20.7–29.4
Working in the usual place of work	43	(11.3)	8.5–14.7
Working from home and at the usual place of work	10	(2.6)	1.5–4.5
Did not work because unemployed (partially or not)	65	(16.7)	13.4–20.6
Did not work for other reasons (maternity leave, etc.)	158	(40.9)	36.0–46.0
Other situation	14	(3.7)	1.9–7.2
Workload during the lockdown			
Did not work	351	(70.1)	65.7–74.2
Lighter or same as usual	85	(17.1)	14.0–20.7
Heavier than usual	64	(12.8)	10.1–16.0
Access to a private or common outdoor space during the lockdown	434	(86.8)	82.8–90.1
Lived with the same people during the lockdown (n = 488)****	472	(96.8)	93.7–98.4
Lived in the same dwelling during the lockdown	478	(95.7)	93.2–97.2
Self-perceived social support during the lockdown			
Very good	180	(36.0)	31.3–40.9

	N (%)*		95%CI*
Good	231	(46.1)	41.2–51.1
Little or none	89	(17.9)	14.5–21.8
Serious disputes or violence during first lockdown			
Yes	11	(2.3)	1.1–4.6
Sometimes / Rarely	129	(25.8)	21.7–30.4
Never	360	(71.9)	67.2–76.2
Level of knowledge about SARS-CoV-2 transmission			
Low	14	(2.8)	1.5–5.2
Medium	35	(7.0)	4.8–10.1
High	451	(90.2)	86.7–92.9
General concern score for the SARS-CoV-2 pandemic (max.10; n = 485) > 7/10 **** #	234	(48.3)	43.3–53.3
Family member or friends diagnosed with COVID-19 or had symptoms suggestive of the disease	171	(34.2)	29.7–39.0
Having had COVID-19 type symptoms	92	(18.4)	14.9–22.6
Clinical characteristics			
Primiparous	203	(40.6)	35.8–45.6
Gestational age (weeks) at the end of first lockdown			
< 10	34	(6.8)	4.7–9.8
10–20	177	(35.4)	30.8–40.3
20–30	180	(36.1)	31.4–41.0

	N (%)*		95%CI*
30–40	77	(15.4)	12.1–19.4
> 40	32	(6.3)	4.3–9.2
Childbirth			
During lockdown	34	(6.8)	4.7–9.8
After lockdown	466	(93.2)	90.2–95.2
Pre-existing Chronic disease(s)	152	(30.3)	25.8–35.1
Overweight/Obesity	212	(42.4)	37.5–47.4
Pregnancy-related pathology(ies)	119	(23.7)	19.9–28.0
Pregnancy monitoring			
Teleconsultations (video or telephone) for pregnancy monitoring	197	(39.4)	34.6–44.4
Change of health professional	74	(14.9)	11.7–18.8
Childbirth preparation sessions (video or telephone)	76	(15.2)	12.0–19.1
Absence of partner/person providing support from a consultation/examination	459	(91.8)	88.8–94.1
Modification [§] of pregnancy monitoring at the initiative of a health professional	182	(36.3)	31.6–41.3
Modification ^{§§} of pregnancy monitoring at the initiative of the women	117	(23.4)	18.8–27.7
* Weighted and rounded values using Newton's algorithm (26)			
** Women on maternity leave and unemployed women were classified according to their current SPC category or their most recent category prior to ending work, respectively			
*** Pressure on the healthcare system as of 01/05/2020			
**** Analysis performed in a sub-group of pregnant women depending on their previous answers			
# No documented data for 15 pregnant women in terms of level of worry about the pandemic			

	N (%)*	95%CI*
\$ Postponing/cancelling pregnancy monitoring		
\$\$ Postponing/foregoing /not starting monitoring despite a gestational age of 15 weeks (see definition of the variable of interest in Methods section).		

From a medical perspective, 42.4% had overweight or obesity before pregnancy, and 23.7% had pregnancy-related pathologies, notably gestational diabetes (12.6%), preterm labour (5.9%), and gestational hypertension (1.6%). Finally, 17.9% perceived receiving little or no social support during the lockdown, and nearly 28% experienced serious arguments and/or a climate of violence during the same period.

Pregnancy monitoring during the first lockdown (Table 1)

A total of 14.9% of women reported that they had been followed by a professional other than the one who usually followed them, 39.4% reported that they had teleconsultations, and 91.8% reported that their partner or a person providing support had not been allowed to attend at least one pregnancy check-up or consultation due to pandemic-related restrictions. In addition, 41% indicated that they unsuccessfully sought exchanges about the SARS-CoV-2 pandemic and their pregnancy with healthcare professionals.

Of the pregnant women who indicated that they had not started their pregnancy monitoring during the lockdown, the majority (63.7%) had a gestational age of over 15 weeks, indicating a delay in the management of their pregnancy.

Voluntary changes in pregnancy monitoring

Just under half of the study sample (48.9%) reported having at least one consultation or pregnancy check-up postponed or cancelled during the lockdown, whether on their own initiative (23.4%) and/or the initiative of the hospital and/or a health professional (36.3%).

The most frequent reasons participants gave for voluntary changes to their pregnancy monitoring were related to the pandemic and lockdown (*i.e.*, fear of being infected with SARS-CoV-2; compliance with restrictions on movement), to personal organisational problems (*e.g.*, caring for other children), and hospital problems (*e.g.*, inability to make an appointment with a health professional) (Fig. 1).

Among women who declared foregoing at least one pregnancy monitoring examination ($n = 75$) as a direct result of the lockdown, almost one-third forewent i) supplementary prescribed or recommended pregnancy monitoring examinations/consultations (31.1%, CI95%[19.8–45.2]) or ii) Trisomy 21 screening (29.2% [17.1–45.1] regardless of gestational age; 17.4% [7.9–33.9] before 16 gestational weeks), iii) one in four reported not having monthly toxoplasmosis serology (25.7%, [14.8–41] (Fig. 2).

After adjusting for age, gestational age and parity during the first lockdown, being inactive (RPa = 1.98, CI95%[1.24–3.16]), having experienced violence (1.47, [1.00-2.16]), having felt little or no support (1.70, [1.07–2.71]), and having changed healthcare professional (1.57, [1.04–2.36]) were all independently and significantly associated with a voluntary change in pregnancy monitoring. Conversely, higher level of worry about the pandemic was inversely associated with voluntary change in pregnancy monitoring (0.66 [0.46–0.96]) (Table 2).

Table 2

Factors influencing the prevalence of voluntary changes in women's pregnancy monitoring during the lockdown period, Covimater survey (n = 500), France, 2020

	Obs. (n %)*		Voluntary changes in medical monitoring of pregnancy initiated by pregnant women (n = 117)****			
			Yes (n %)*		Adjusted PR [95% CI] **	p-value**
Age (in years) [#]	31.4	(5.1)	32	(5.6)	0.99 [0.96–1.03]	0.77
Socio-professional categories***						
SPC +	192	(38.4)	38	(32.7)	1	
SPC-	180	(36.1)	29	(24.7)	0.71 [0.46–1.12]	0.14
Inactive	128	(25.5)	50	(42.6)	1.98 [1.24–3.16]	0.004
Pregnancy term ^{\$#}	23.5	(9.0)	24	(8.9)	1.00 [0.98–1.02]	0.84
Parity						
Primiparous	203	(40.6)	48	(40.7)	1	
Multiparous	297	(59.4)	69	(59.3)	0.96 [0.64–1.43]	0.84
Level of perceived social support received during the lockdown						
Very good	180	(36)	40	(34.0)	1	
* Weighted and rounded values using Newton's algorithm (26)						
** Adjusted Prevalence Ratio (aPR), Confidence Interval 95% (95% CI) with Poisson regression with robust error variance						
*** Women on maternity leave and unemployed women were classified according to their current SPC category or their most recent category prior to ending work respectively						
**** Postponing/foregoing /not starting monitoring despite a gestational age of 15 weeks (see definition of the variable of interest in Methods section).						
^{\$} At the end of the first lockdown (11/05/2020),						
^{\$\$} 15 women did not document their worry score						
[#] Mean (standard deviation-sd)						

	Obs. (n %)*		Voluntary changes in medical monitoring of pregnancy initiated by pregnant women (n = 117)****			
			Yes (n %)*		Adjusted PR [95% CI] **	p-value**
Good	231	(46.1)	48	(41.4)	0.95 [0.62–1.46]	0.82
Little or none	89	(17.9)	29	(24.6)	1.70 [1.07–2.71]	0.03
Serious disputes or violence during the lockdown						
No	360	(71.9)	74	(63.2)	1	
Yes	140	(28.1)	43	(36.8)	1.47 [1.00-2.16]	0.05
Perceived general worry about the SARS-CoV-2 pandemic in France (max.10)\$\$						
Score less than or equal to 7	251	(51.7)	67	(61.7)	1	
Score above 7	234	(48.3)	42	(38.3)	0.66 [0.46–0.96]	0.03
Change in health professional for pregnancy monitoring during the lockdown						
No	426	(85.1)	90	(77.1)	1	

* Weighted and rounded values using Newton's algorithm (26)

** Adjusted Prevalence Ratio (aPR), Confidence Interval 95% (95% CI) with Poisson regression with robust error variance

*** Women on maternity leave and unemployed women were classified according to their current SPC category or their most recent category prior to ending work respectively

**** Postponing/foregoing /not starting monitoring despite a gestational age of 15 weeks (see definition of the variable of interest in Methods section).

\$ At the end of the first lockdown (11/05/2020),

\$§ 15 women did not document their worry score

Mean (standard deviation-sd)

	Obs. (n %)*		Voluntary changes in medical monitoring of pregnancy initiated by pregnant women (n = 117)****			
			Yes (n %)*		Adjusted PR [95% CI] **	p-value**
Yes	74	(14.9)	27	(22.9)	1.57 [1.04–2.36]	0.03
* Weighted and rounded values using Newton's algorithm (26)						
** Adjusted Prevalence Ratio (aPR), Confidence Interval 95% (95% CI) with Poisson regression with robust error variance						
*** Women on maternity leave and unemployed women were classified according to their current SPC category or their most recent category prior to ending work respectively						
**** Postponing/foregoing /not starting monitoring despite a gestational age of 15 weeks (see definition of the variable of interest in Methods section).						
\$ At the end of the first lockdown (11/05/2020),						
\$ \$ 15 women did not document their worry score						
# Mean (standard deviation-sd)						

Discussion

Just under half the study sample (48.9%) reported at least one consultation or pregnancy check-up being postponed or cancelled during the first lockdown, whether on their own initiative (23.4%) and/or the initiative of the hospital and/or that of a health professional (36.3%).

Women who i) were inactive, ii) perceived received little or no social support, iii) experienced violence, and whose iv) healthcare professional changed during the first lockdown, were all significantly more likely to voluntarily change their pregnancy monitoring. Conversely, worry about the pandemic was inversely associated with changing pregnancy monitoring.

Covimater's results show an association between violence and a voluntary change in pregnancy monitoring. The percentage of pregnant women who reported experiencing violence or serious arguments during the first lockdown was high (28.1%), but significantly lower than that obtained for women of childbearing age (18–49 years) in CoviPrev, a French general population-based repeated cross-sectional study which used the same methodology as Covimater and conducted data-collection waves at the same time (CoviPrev study, 28.1% vs. 32.9%, $p = 0.03$) (33). This result is in line with several studies suggesting that the prevalence of violence on women during pregnancy is no higher than in other situations. However, there is no international consensus about whether the risk of violence is higher in pregnant

women than in women who are not pregnant (34–36). Violence during pregnancy not only negatively impacts mothers' health, but also that of their unborn children. It also impacts success of antenatal care (40,43–45). Furthermore, violence is significantly associated with an increased risk of obstetrical complications (40,43–45). In terms of antenatal care, a survey held by the World Health Organisation in Tanzania studying domestic violence on women showed that it was significantly associated with fewer consultations for antenatal care because partners prevented or discouraged women from having them (36). Efforts to detect violence against pregnant women at an early stage must be continued in order to prevent its harmful impact on health (40).

In Covimater, perceiving little or no support during the lockdown was associated with voluntary change in pregnancy monitoring. These results reflect findings from the 2010 French National Perinatal Survey (NPS), where women who declared having no social support were significantly more likely to forego care (41). The perception of receiving little support may have been accentuated by the fact that during the first lockdown, in many maternity hospitals and private practices in France, neither partners nor people providing support to pregnant women were allowed to be present at consultations, obstetrical examinations, and hospitalisation for childbirth, except under certain conditions (15,18)). Only partners were allowed to visit after childbirth (15).

In our analyses, a change in health professional during the lockdown was associated with a higher likelihood of voluntarily postponing or foregoing pregnancy monitoring. As reported in several studies showing the importance of the patient/caregiver relationship in medical follow-up (in terms of treatment adherence, health examinations, etc.), it seems fundamental to ensure that the monitoring of pregnant women is as personalized as possible in the context of an ongoing pandemic (42,43).

In our study, women who had a higher worry score about the pandemic were less likely to change their pregnancy monitoring. This result suggests the need to communicate with pregnant women with a double objective: i) to avoid any increase in existing worry about the pandemic, and ii) to foster their adherence to health authorities' recommendations concerning uninterrupted pregnancy monitoring. To ensure the quality and regular updating of information received by pregnant women, it is important to involve health care providers so that they can inform or direct their patients to reliable and responsive sources of information (44). French laws for patients' rights and the Public Health Code stipulate that patients have the right to have access to information (45) and that doctors must inform them of advances in science according to their needs (46). Access to reliable information is therefore an essential element in effective patient follow-up.

Finally, in line with Ancelot *et al.*'s findings in the NPS study in France in 2010 (41), having a chronic illnesses or a pregnancy-related illness was not significantly associated with a voluntary change in pregnancy monitoring in Covimater. Furthermore, participants in Covimater with a deteriorated psychological state during the first lockdown were not more likely to change their pregnancy monitoring than those with no such condition (p-value = 0.89).

In addition to characterising women with a higher prevalence of modifying their pregnancy monitoring during the first COVID-19-related lockdown in France, our study also aimed to stress the reasons for these voluntary postponements or waiving of care. In addition to those related to the pandemic (*i.e.*, fear of being infected by SARS-CoV-2, compliance with restrictions on movement), some of these reasons were organisational in nature, whether related to healthcare provision, or personal organisation problems linked to the pandemic. In Covimater, 28.6%, 17.7% and 15.3% declared, respectively, that they had not managed to make an appointment, that they had not been able to contact the health professional who usually followed them, or that it had been impossible for them to take days off work to attend their pregnancy appointments. Despite French authorities' recommendations to promote video and telephone-based consultations when possible outside of the three compulsory ultrasounds requiring physical presence, a relatively large proportion of women were unable to contact healthcare structures, and as a consequence, modified their pregnancy monitoring (15,53–55). In terms of personal organisation of healthcare schedules, discussions are currently underway at the national level to provided current and future parents with greater flexibility to better reconcile their professional and parenthood (50).

Strengths and limitations

To the best of our knowledge, Covimater is the first national study in France to explore the experiences and behaviours of pregnant women during the SARS-CoV-2 pandemic. It used the same methodology as another study conducted in France at the same time on the general population entitled Coviprev. This choice was made to ensure comparison with women of childbearing age. Unlike studies from other countries which mostly focused on the third trimester of pregnancy during the current pandemic, Covimater included women with different gestational ages.

Covimater has some limitations. First, the probability of inclusion of individuals from the whole population of pregnant women in France was unknown. Consequently, greater caution is required when interpreting the statistical inference than would be needed for random sample studies. Second, sampling bias could explain the overestimation of the percentage of pregnant women with pre-existing chronic diseases or obesity. Third, as the study questionnaire was self-administered, there is always the risk that respondents misunderstood or misinterpreted questions and a risk of potential social desirability and recall biases. However, there is no reason to suppose that either of these biases should be limited to the particular sub-group of pregnant women who had postponed/forgone their pregnancy monitoring.

Conclusion

The results of this study highlight the importance of defining strategies to prevent voluntary changes in pregnancy monitoring among women in difficult social situations (isolation, violence), which may be accentuated by the ongoing COVID-19 pandemic. In addition, it is necessary to increase access to teleconsultations and provider-patient communication channels during pandemics. Despite the continued difficulties that countries around the world are still facing, this period provides an unprecedented opportunity for maternity units and hospitals to rethink their organisations and reinforce access to care

for future health crises and ensure effective and efficient follow-up of pregnant women. One possible strategy - currently being discussed at the national level - is to coordinate all concerned professionals around a reference person (50).

Declarations

Ethics approval and consent to participate

Covimater received approval from the Saint Maurice Hospital Ethics Committee on 01/07/2020 (approval number n°2020-1). We confirm that the Internet panel volunteers, included in the Covimater study, were informed of the purpose of the study at the time of their inclusion, then they were free to participate or not in the survey. No subjects under 18 were included in the study. Only pseudonymised databases were transmitted to Santé Publique France.

Consent for publication

Only aggregated data is reported in this article. No personal information appears in this article.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due privacy or ethical restrictions but are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' contributions

A.D., L.A. and N.R. conceived of the presented idea. L.A. and A.D. developed the theory and performed the computations. N.R. verified the analytical methods. All authors discussed the results and contributed to the final manuscript.

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Figures

Figure 1

Reasons given by pregnant women to explain a voluntarily change\$ in their pregnancy monitoring during lockdown, Covimater survey; Women who changed their pregnancy monitoring (n=107), metropolitan France, 2020 Percentage (%) of women who had voluntarily postponed/forgone their pregnancy monitoring *Analysis carried out in a subgroup of women (who had children or who were working during the lockdown) \$: Postponing/foregoing /not starting monitoring despite a gestational age of 15 weeks (see definition of the variable of interest in Methods section). Available data (n=107)

Figure 2

Foregoing of pregnancy monitoring examinations during the lockdown, Covimater survey; (n=75), metropolitan France, 2020